Madroño, Vol. 60, No. 1, pp. 46–54, 2013

MONARDELLA EPLINGII, A NEW SPECIES FROM THE BLACK MOUNTAINS OF NORTHWESTERN ARIZONA, USA

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Abstract

Monardella eplingii Elvin, A. C. Sanders, & J. L. Anderson (Lamiaceae), a new species from the Black Mountains of northwestern Arizona is described and illustrated. This new species is similar to *M. arizonica* Epling, *M. eremicola* A. C. Sanders & Elvin, *M. robisonii* Epling, *M. mojavensis* Elvin & A. C. Sanders, *M. boydii* A. C. Sanders & Elvin, *M. linoides* A. Gray subsp. *linoides*, and *M. linoides* subsp. *erecta* (Abrams) Elvin & A. C. Sanders. It differs from these taxa in leaf and bract morphology, pubescence on the stems and calyces, soil and geologic affinities, and distribution. A key is included for the *Monardella* of the eastern Mojave Desert region.

Key Words: Arizona, Black Mountains, Epling, Lamiaceae, Mojave Desert, *Monardella*.

Monardella Bentham (Lamiaceae) is a complex genus that occurs throughout western North America in Mexico, the United States, and Canada. There are over 30 species of annuals and perennials with more than 50 taxa currently recognized. Since first being described in 1834 (Bentham 1834), 215 names and combinations have been published in *Monardella* and the synonymous genus *Madronella* Greene (IPNI 2012). During recent taxonomic work for the publication of *The Jepson Manual, 2nd ed.* (Baldwin et al. 2012), nine new taxa were described from California (Elvin and Sanders 2009). We noted at that time that there are additional undescribed taxa throughout the range of this genus that we were unable to address because of the timeline for publication. Many specimens have been unavailable for review and analysis by us during the past several years; therefore, this manuscript will only address one new species from Arizona for which we were able to acquire a sufficient quantity of material, and which was out of the range of those taxa treated in *The Jepson Manual.* An additional impetus for the timing of this description is that areas within the entire range of this new species are being considered for renewable energy development.

Within the genus as a whole, there is a cluster of closely related, perennial taxa distributed throughout the Mojave Desert region characterized by branched inflorescences bearing multiple, small glomerules (a cyme condensed into a head-like cluster) on each stem (in contrast to the perennial, non-desert *Monardella* taxa characterized by unbranched inflorescences bearing larger, solitary, terminal glomerules).

The desert taxa occur as isolated populations within discrete mountain ranges. These populations appear to represent incipient speciation and tend to differ in relatively small but consistent traits such that all individuals from a particular mountain range can readily be identified as having come from that range and not another. One hypothesis to explain this divergence of taxa is that they may all be recent products of the breakup of a more widespread population system across the Mojave Desert during the Pleistocene, when pinyon woodlands covered much of the lowland Southwest (Van Devender et al. 1985).

The desert taxa tend to be isolated in the higher elevations associated with mountains and are surrounded by large expanses of relatively low, flat, hot deserts where perennial *Monardella* have never been documented. The expansion of deserts over the past 11,000 years may have disrupted gene flow in a formerly continuous population. Allopatric or peripatric populations may have developed and diverged in response to isolation, genetic drift, and directional selection for survival on differing substrates. It has long been noticed that some *Monardella* appear to be specialized for

[1] The findings and conclusions in this article/publication are those of the author and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

particular substrates (Epling 1939; Hardham and Bartel 1990; Elvin and Sanders 2003, 2009). Two other theories that may explain the unresolved relationships between the *Monardella* in the deserts are: 1) reticulation of taxa (as indicated by cladograms) over one or more climatic change events, and 2) convergent evolution. The reticulation/multiple expansions theory could help explain the difficulty that botanists have determining what and how many taxa exist throughout the genus.

Taxonomically Important Characters in *Monardella*

The taxonomy of and relationships in the genus *Monardella* have been difficult to understand, and there has been a great deal of confusion regarding the validity and circumscription of the taxa over the past 179 years. Morphological characters that have regularly been used to distinguish taxa in *Monardella* include plant habit; leaf, bract, and inflorescence morphology; and pubescence (Gray 1876, 1886; Abrams 1912a, b, 1951; Epling 1925, 1939; Jepson 1925, 1943; Munz 1935, 1959, 1974; Jokerst 1993; Elvin and Sanders 2003, 2009). Of the 215 published names, only 50 to 60 taxa are currently recognized, which illustrates some of the difficulties that all botanists studying this genus have had. Determining the circumscription of taxa in *Monardella* is not simple or obvious.

Some characters in the genus are highly variable, but can still assist in identification (e.g., leaf morphology, petiole length, flower and bract color, stem length). Other characters are variable in some taxa, but more consistent in others (e.g., calyx length, bract morphology), while still other traits have no observable variation within a species (e.g., stem, calyx pubescence). In the perennial desert *Monardella*, the stem and calyx pubescence is very consistent and is among the most reliable of morphologic characters for identification. The trichomes on the stems and calyces of these *Monardella* do not form a gradient from short to long, but instead fall into discrete categories, whether they are on new growth or mature stems and calyces. Some types are gland-tipped while others are nonglandular.

The four types of trichomes on the stems of the desert *Monardella* include: very minute, gland-tipped 0.01–0.03 mm; minute, nonglandular 0.03–0.05 mm; short, nonglandular 0.1–0.25 mm; and long, spreading, nonglandular 0.3–0.5 mm. The five types of trichomes on the calyces of the desert *Monardella* include: very minute, gland-tipped 0.01–0.02 mm; minute, gland-tipped 0.06–0.1 mm; minute, nonglandular 0.03–0.05 mm; short, nonglandular 0.2–0.3 mm; and long, spreading, nonglandular 0.3–0.6 mm. Unfortunately, most of these trichomes cannot be seen well with a standard 10× hand lens, but, instead, require the use of a microscope. While this does not lend itself to easy identification in the field, it does provide for accurate identification.

Taxonomy

Monardella eplingii Elvin, A. C. Sanders, & J. L. Anderson, sp. nov. (Figs. 1 and 2).—TYPE: USA, Arizona, Mohave Co., Black Mountains, canyon ca. 2.0 km SSE Sitgreaves Pass, volcanic soils, 35 d 01.685 m -114 d 21.148 m, 1125 m elevation, 4 September 2009, *M. A. Elvin 6379* with G. L. Clifton and M. Glenn (holotype: ASU; isotypes: ARIZ, ASC, DES, GH, GMDRC, JEPS, RSA, UCR).

Subshrub to shrub; similar to *Monardella arizonica* Epling, but differs in having bracts shorter and narrower, leaves narrower; similar to *M. eremicola* A. C. Sanders & Elvin, but differs in lacking conoideus glands on stems and having some sparse, long, spreading, nonglandular trichomes on stems longer than 0.3 mm.

Subshrub to shrub, (12)15–30(35) cm tall, erect, stems visibly woody at base; pubescence sparse to dense, stem trichomes four types: very minute, gland-tipped 0.01–0.03 mm; minute, nonglandular 0.03–0.05 mm; short, nonglandular 0.1–0.25 mm; and sparse, long, spreading, nonglandular 0.3–0.5 mm. Leaves 12–20 × 2–5 mm, length:width = 3–5:1, narrowly elliptic, apex acute (rarely obtuse), pale or grayish green, base acute, subglabrous to sparsely puberulent above and sparsely puberulent below, especially on the veins, subsessile, petioles (0)1–2 mm. Inflorescence generally an open compound cyme (occasionally solitary), multiple stems per plant. Glomerules (1)3–5 per main stem, 7–12 mm wide. Bracts 4–7 × 1.5–2(3) mm, green to purple tinted, narrowly elliptic to narrowly lanceolate, apex acute, apices less than or equaling apices of the calyces. Calyx 5–6 mm, green to purple tinted, trichomes two types: minute, gland-tipped 0.06–0.1 mm and short, nonglandular 0.2–0.3 mm. Corolla 9–10 mm, weakly bilaterally symmetrical, white with purple markings, appearing lavender. Nutlets light brown, oblong, 1.5 mm long.

All known occurrences and collections of *M. eplingii* are from the Black Mountains of Mohave Co., Arizona at the eastern edge of the Mojave Desert (Fig. 3). The westernmost mountain range in northwestern Arizona, the Black Mountains, lie immediately east of the Colorado River and differ from the surrounding mountain ranges and desert floor in Arizona, Nevada, and California by the volcanic nature of their geology. This provides a distinct, edaphic habitat for *M. eplingii* and essentially forms a desert "sky island." The Black Mountains are of mid-Tertiary origin, whereas other nearby mountain ranges, the Cerbat, Hualapai, and Mohave Mountains in Mohave Co., Arizona, and the Newberry Moun-

FIG. 1. *Monardella eplingii*. Habit (center) typical plant in spring. Glomerule (upper right).

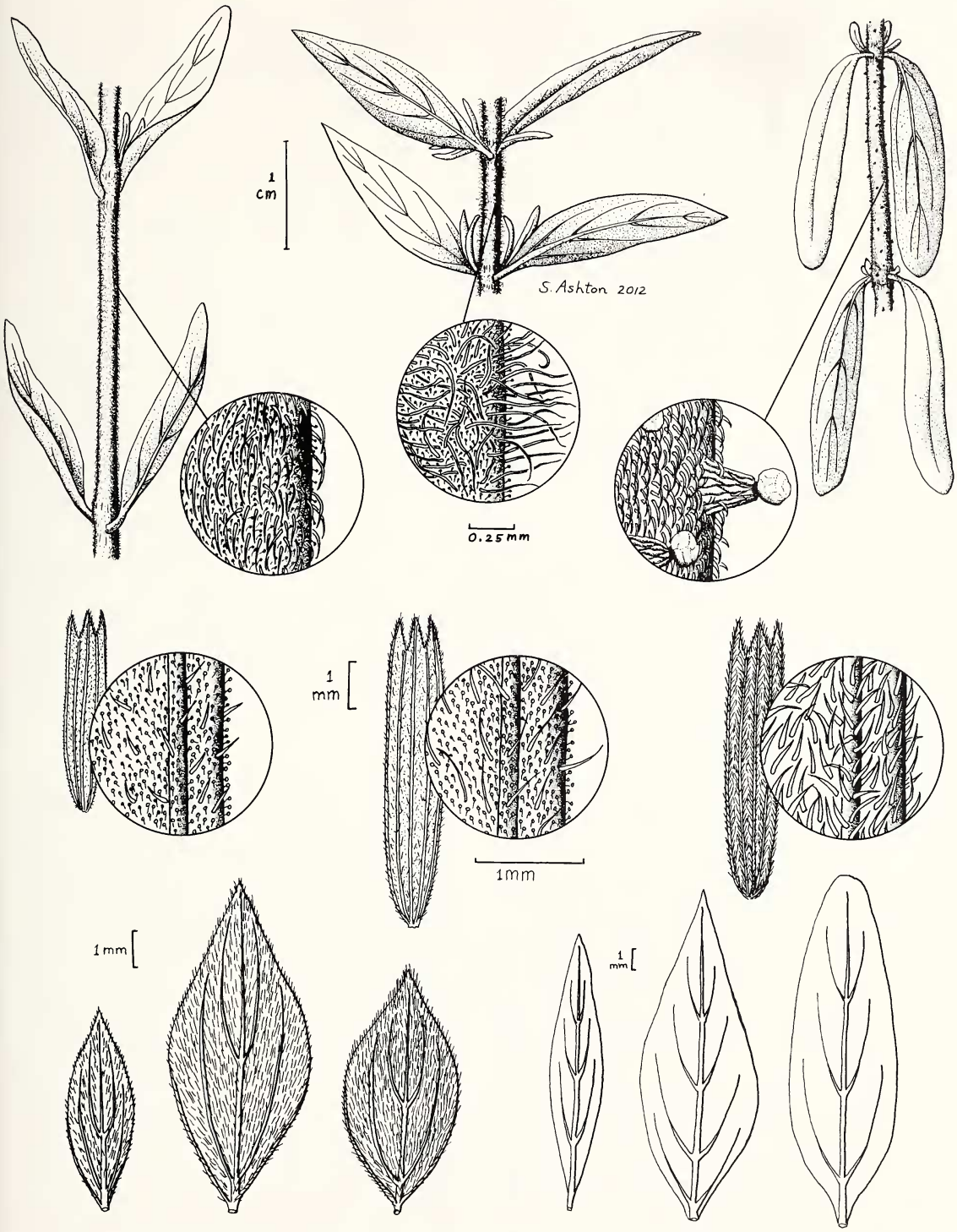

FIG. 2. Comparison of characters between *Monardella eplingii* (left), *M. arizonica* (center), *M. eremicola* (right). Top: stem internodes, stem pubescence in roundel. Center: calyces, calyx pubescence in roundel. Bottom: left, bracts; right, leaves.

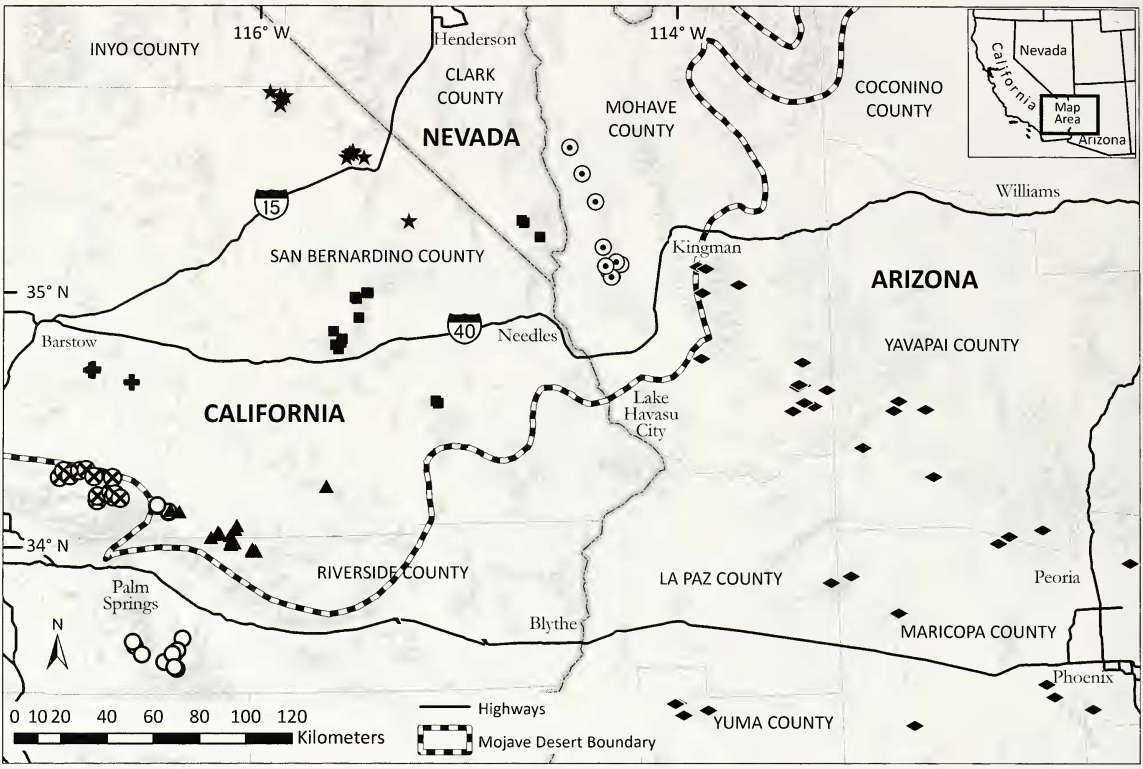

FIG. 3. Distribution of *Monardella eplingii* (⊙), *M. arizonica* (◆), *M. eremicola* (★), *M. robisonii* (▲), *M. mojavensis* (■), *M. boydii* (+), *M. linoides* subsp. *linoides* (○), and *M. linoides* subsp. *erecta* (⊗). The Mojave Desert boundary was developed by the U.S. Environmental Protection Agency, Mojave Basin and Range Ecoregion Assessment (U.S. Environmental Protection Agency 2005).

tains in Clark Co., Nevada (locality of the recently described *M. mojavensis* Elvin & A. C. Sanders), are of early Proterozoic granitic and metamorphic origin (Richard et al. 2000). The major geologic unit in the Black Mountains is classified as Middle Miocene to Oligocene volcanic rocks. The compositionally variable, volcanic substrates include andesite, rhyolite, and tuff (Richard et al. 2000). There are extensive ash-flow tuffs throughout this mountain range and it is the major substrate at the type locality. *Monardella eplingii* is found throughout the Black Mountains on these volcanic substrates.

Monardella eplingii occurs in mixed Mojave Desert scrub, desert riparian scrub, and among scattered shrubs of interior chaparral between 850–1100 m elevation. It occurs mostly in the cracks of bedrock and boulders along intermittent drainages, rock outcrops, and cliffs, but also along the bottoms of ephemeral washes and on open, gravelly or rocky slopes. It has been described on herbarium labels variously as "local, not common," "rare shrub," "uncommon," "occasional," and "scarce to locally occasional."

Associated species include *Eriogonum heermannii* Dur. & Hilg., *Senegalia greggii* Britton & Rose, *Salvia mohavensis* Greene, *Larrea tridentata* (DC.) Coville, *Fouquieria splendens* Engelm. subsp. *splendens*, *Hyptis emoryi* Torr., *Scutellaria mexicana* (Torr.) A. J. Paton, *Ephedra aspera* Engelm. ex S. Watson, *Ericameria laricifolia* (A. Gray) Shinners, *Yucca schidigera* Ortgies, *Juniperus californica* Carrière, *Nolina bigelovii* (Torr.) S. Watson, *Keckiella antirrhinoides* (Benth.) Straw, *Sclerocactus johnsonii* (Engelm.) N. P. Taylor, and *Coleogyne ramosissima* Torr. Another local endemic, *Penstemon bicolor* (Brandegee) Clokey & D. D. Keck, is also a common associate.

Based on the phenology of the material on herbarium specimens, *M. eplingii* appears to be on a typical Mojave Desert shrub phenological schedule with the main flowering period occurring in late summer to early fall. It also occasionally flowers into early winter and has been documented producing a few flowers throughout the year (e.g., in December, January, and April), which appear to be opportunistic after rains.

Etymology

The specific epithet refers to Carl Epling who first noted the distinctiveness of the *Monardella* plants in the Black Mountains. He published his

observations regarding their resemblance to *Monardella epilobioides* Greene [*M. linoides* A. Gray subsp. *erecta* (Abrams) Elvin & A. C. Sanders] (endemic to the San Bernardino Mountains) in his description of *M. arizonica* (Epling 1939). He labeled his collection from "Battleship Rock, Ute [Black] Mountains, [Mohave Co.,] Arizona" in 1935 (*C. C. Epling s.n.*, CAS 299247, RSA 580012) as "*M. epilobioides*." In his treatment of the *Monardella* from Arizona (Epling 1951), he noted that "[t]he plant of the Black Mountains may not be conspecific [with *M. arizonica*]." In addition to discussing the distinctiveness of the plants from the Ute [Black] Mountains in his 1951 treatment, he also discussed the distinctiveness of other plants in the *M. linoides s.l.* complex, including plants from the different Mojave Desert mountain ranges (Elvin and Sanders 2009). However, he never described the Black Mountains taxon because he was cautious and wanted to wait to publish it until "further evidence has accumulated as to the range of variation of each [of the desert taxa], as well as their cytology."

We name this taxon in Epling's honor—for his extensive efforts towards creating a better understanding of the taxonomy of *Monardella*, his love of the genus, his caution for waiting for sufficient evidence to publish his theories, and his many years of dedication to botany.

Similar Taxa

Monardella eplingii is most similar to the other *Monardella* in the Mojave Desert: *M. arizonica*, *M. eremicola*, *M. robisonii* Epling, *M. mojavensis*, and *M. boydii* A. C. Sanders & Elvin; but it also has affinities with *M. linoides* subsp. *linoides* and *M. linoides* subsp. *erecta*. Collections of *Monardella* from the Black Mountains have been variously identified and labeled as *M. arizonica* (e.g., *W. Hodgson 9159*; *M. Butterwick H793*), *M. linoides* (e.g., *J. L. Anderson 2006-1*; *J. L. Anderson 95-22*; *S. Braem s.n.*, POM 192565), *M. epilobioides* (e.g., *C. C. Epling s.n.*, RSA 580012), and *M. robisonii* (e.g., *L. N. Goodding 6024*). It is similar to all of these species in general habit, vestiture, and inflorescence structure. All *Monardella* in the Mojave and Sonoran deserts contain multiple glomerules per main stem. However, *M. eplingii* differs from each of these other taxa by multiple characters (Table 1). Certain characters (e.g., leaf size) can vary on individuals within a given *M. eplingii* population and approach the aspects of some of the other desert *Monardella*. For instance, larger leaves of some *M. eplingii* individuals can overlap in size with diminutive leaves of some *M. arizonica* individuals. *Monardella eplingii* is most similar to *M. arizonica* and *M. eremicola* and contains a mixture of characters from both of those taxa (Table 1). *Monardella eplingii* is peripatric with all nearby or similar taxa (Fig. 3).

Most of the *M. eplingii* specimens previously collected were identified as *M. arizonica* (Epling 1925, 1935, 1939, 1951; McDougall 1973; Trauth-Nare 2003). *Monardella eplingii* differs from *M. arizonica* in that it has minute, nonglandular trichomes on the stems; narrower leaves; shorter and narrower bracts; short, nonglandular trichomes on the calyces; shorter corollas; and it lacks the long, spreading, nonglandular trichomes on the calyces. While most *M. eplingii* individuals contain some sparse, long, spreading, nonglandular trichomes on the stems, it lacks the abundance of this type of trichome, which is one of the distinguishing characters for *M. arizonica*. The density of the short, nonglandular trichomes (0.1–0.25 mm) on the stems of *M. eplingii* makes it difficult to see the very minute, gland-tipped trichomes (0.01–0.03 mm) underneath. The short, nonglandular trichomes on the stems of *M. arizonica* are much less dense and it is easier to see the very minute, gland-tipped trichomes underneath. There is overlap in some of the more variable characters between *M. eplingii* and *M. arizonica* (e.g., leaf length), as is the case with many phenotypic characters throughout the genus (Epling 1925; Abrams 1912a, b; Gray 1886; Jepson 1925, 1943; Munz 1935, 1959, 1974; Jokerst 1992, 1993; Hardham 1966a, 1966b; Elvin and Sanders 2003, 2009; Sanders, Elvin, and Brunell 2012). These two species occur on different soil substrates and have different plant associations. While they occur within 30 km of each other, their distributions do not overlap. *Monardella eplingii* is endemic to the Mojave Desert and *M. arizonica* is endemic to the Sonoran Desert (Fig. 3).

Monardella eplingii differs from *M. eremicola* in that it lacks prominent conoideus glands on the stems. Conoideus glands are miniature, stout protuberances that are subcylindrical to conical in shape and resemble miniature volcanoes (Fig. 2; and see Fig. 7 in Elvin and Sanders 2009). *Monardella eplingii* also differs from *M. eremicola* in that it has very minute, gland-tipped trichomes on the stems; narrower leaves and bracts; and minute, gland-tipped trichomes on the calyces. These two species occur on different soil substrates and have different plant associations. Their distributions and elevational ranges do not overlap and they are separated by approximately 70 km.

Some *M. eplingii* collections have been labeled as *M. robisonii*, indicating their general similarity. Both species contain very minute, gland-tipped and short, nonglandular trichomes on the stems. Of the desert *Monardella*, these very minute, gland-tipped trichomes are only found on *M. eplingii*, *M. arizonica*, and *M. robisonii*. The abundance of long, spreading, nonglandular

TABLE 1. COMPARISON OF CHARACTERS BETWEEN *MONARDELLA EPLINGII* AND SIMILAR *MONARDELLA* TAXA.

Monardella taxa (mm unless otherwise noted)	*eplingii*	*arizonica*	*eremicola*	*robisonii*	*mojavensis*	*boydii*	*linoides* subsp. *erecta*	*linoides* subsp. *linoides*
Stem length (cm)	(12)15–30(35)	(15)30–60+	15–55	15–50	30–60	12–40	15–30	18–50
Stem conoideus glands	no	no	yes	no	no	no	no	no
Stem trichomes: gland-tipped 0.01–0.03	yes	yes	no	yes	no	no	no	no
Stem trichomes: nonglandular 0.03–0.05	yes	no	yes	no	yes	yes	yes	yes
Stem trichomes: nonglandular 0.1–0.25	yes	yes	yes	yes	no	no	no	no
Stem trichomes: nonglandular 0.3–0.5	yes (sparse)	yes (abundant)	no	yes (abundant)	no	no	no	no
Leaf length	12–20	12–23	12–27	8–20	8–20	7–15	12–19	10–25
Leaf width	2–5	(3)4–10	3–10	2–6	2–4	1–3(5)	2–4	2–4
Glomerule width	7–12	(7)9–15	7–20	7–20(25)	10–20	10–20	7–18	10–22
Glomerules per stem	(1)3–5	(1)3–7(11)	(1)3–5	3–7	3–7	(1)3–5	1	1(3)
Bract length	4–7	8–10	4.5–9	9–12	10–11	8–9	6–11	10–15
Bract width	1.5–2(3)	3–5	2–4.5	3–5	2–5	2–3	2–4	5–12
Relative bract/calyx apex position	≤	>	+/− =	>	>	≤	=	>
Calyx length	5–6	5–9	5–7	6–9	5–7	6–8	6–9	8–9
Calyx trichomes: gland-tipped 0.01–0.02	no	no	no	no	yes	yes	yes	no
Calyx trichomes: gland-tipped 0.06–0.1	yes	yes	no	no	yes	no	no	no
Calyx trichomes: nonglandular 0.03–0.05	no	no	no	no	no	no	no	yes
Calyx trichomes: nonglandular 0.2–0.3	yes	no	yes	yes	no	yes	yes	no
Calyx trichomes: nonglandular 0.3–0.6	no	yes	no	no	no	no	no	no
Corolla length	9–10	10–13	8–11	9–11	10–11	10–11	10–11	10–14
Geology/substrate	volcanic: tuff, andesite and rhyolite	granitic	limestone	granitic	granitic	volcanic: basalt	granitic	granitic
Elevation (m)	850–1100	550–2000	1500–2100	1100–1350	800–1500	1400–1650	1800–2600	900–2000

trichomes on the stems of *M. robisonii* readily distinguishes it from *M. eplingii*. *Monardella eplingii* further differs from *M. robisonii* in that it has shorter and narrower bracts; shorter calyces; and minute, gland-tipped trichomes on the calyces. These two species occur on different soil substrates and have different plant associations. Their distributions and elevational ranges do not overlap and they are separated by a distance of approximately 140 km.

Monardella eplingii differs from *M. mojavensis* in that it has shorter stems; very minute, gland-tipped and short, nonglandular trichomes on the stems; shorter and narrower bracts; short, nonglandular trichomes on the calyces; and shorter corollas. *Monardella eplingii* lacks the very minute, gland-tipped trichomes that are on the calyces of *M. mojavensis*. These two species occur on different soil substrates, have different plant associations, and their distributions do not overlap.

Monardella eplingii differs from *M. boydii* in that it has very minute, gland-tipped and short, nonglandular trichomes on the stems; generally longer leaves; smaller glomerules; shorter and narrower bracts; shorter calyces and corollas; and minute, gland-tipped trichomes on the calyces. *Monardella eplingii* lacks the very minute, gland-tipped trichomes that are on the calyces of *M. boydii*. These two species occur on different soil substrates and have different plant associations. Their distributions and elevational ranges do not overlap and they are separated by approximately 200 km.

Some specimens of *M. eplingii* have been identified as *M. linoides s.l.,* presumably based on the abundance of short, nonglandular trichomes (0.1–0.25 mm) on the stems. All of the perennial *Monardella* taxa in the eastern Mojave Desert were historically thought to be *M. linoides* subsp. *linoides*. *Monardella linoides* subsp. *linoides* does not occur in the eastern Mojave Desert. *Monardella eplingii* differs from *M. linoides* subsp. *linoides* in that it has very minute, gland-tipped; short, nonglandular; and sparse, long, spreading, nonglandular trichomes on the stems; smaller glomerules; considerably shorter and narrower bracts; shorter calyces and corollas; and minute, gland-tipped and short, nonglandular trichomes on the calyces. *Monardella eplingii* lacks the minute, nonglandular trichomes that area on the calyces of *M. linoides* subsp. *linoides*. These two species occur on different soil substrates and have different plant associations. Their distributions do not overlap and they are separated by approximately 220 km.

Monardella eplingii differs from *M. linoides* subsp. *erecta* in that it has very minute, gland-tipped trichomes; short, nonglandular trichomes; and sparse, long, spreading, nonglandular trichomes on the stems. It also has multiple glomerules per main stem; shorter and narrower bracts; shorter calyces and corollas; and minute, gland-tipped trichomes on the calyces. *Monardella eplingii* lacks the very minute, gland-tipped trichomes that are on the calyces of *M. linoides* subsp. *erecta*. These two species occur on different soil substrates and have different plant associations. Their distributions and elevational ranges do not overlap and they are separated by approximately 230 km.

Paratypes. USA, Arizona, Mohave Co., *J. L. Anderson 95-22* (ASU, herbarium at the Arizona Bureau of Land Management Phoenix District Office [azblm]!); *J. L. Anderson 2006-1* (ASU [digital image!], azblm!); *J. L. Anderson 2012-7* (ASU, azblm!); *S. Braem s.n.*, Dec 1927 (DS 190646!, POM 192565!); *M. Butterwick 8927* (ASU!); *M. Butterwick H793* (ASC, DES 19412 [digital image!], DES 19322 [digital image!]; *G. L. Clifton 39183* (Clifton's personal herbarium!); *T. F. Daniel 4550* (CAS [digital image!]); *T. F. Daniel 4574* (CAS [digital image!]); *M. A. Elvin 6291* (UCR!); *M. A. Elvin 6292* (CIC!, GMDRC!, UCR!); *M. A. Elvin 6293* (OSC!, SBBG!, UCR!); *M. A. Elvin 6294* (OBI!, UCR!, VFWO!); *M. A. Elvin 6295* (LA!, UCR!, WIS!); *M. A. Elvin 6296* (BRY!, CAS!, GH!, K!, MO!, NDG!, NY!, UCR!); *M. A. Elvin 6299* (UCR!, UCSB!); *M.A. Elvin 6300* (RM!, SD!, UCR!, UNLV!, VFWO!); *M. A. Elvin 6301* (GMDRC!, UCR!); *M. A. Elvin 6302* (ASDM!, UCR!, US!); *M. A. Elvin 6303* (CAS!, UCR!); *C. C. Epling s.n.*, 17 June 1935 (CAS 299247!, RSA 580012!), *L. N. Goodding 6024* (RM [digital image!]); *W. C. Hodgson 9159* (ASC, ASU [digital image!], DES [digital image!]); *W. C. Hodgson 9204* (ASC, DES [digital image!]).

Key to the *Monardella* Species of the Eastern Mojave Desert region

1. Stems with conoideus glands, calyx lacking minute gland-tipped trichomes 0.06–0.1 mm. . . . . *M. eremicola*

1′ Stems lacking conoideus glands, calyx with minute, gland-tipped trichomes 0.06–0.1 mm

2. Stem trichomes ≥0.3 mm abundant, calyx trichomes ≥0.3 mm present . . . . *M. arizonica*

2′ Stem trichomes ≥0.3 mm sparse or absent, calyx trichomes ≥0.3 mm absent

3. Bracts >7.5 mm long; corolla ≥10 mm. . . . . *M. mojavensis*

3′ Bracts <7.5 mm long; corolla ≤10 mm. . . . . *M. eplingii*

Acknowledgments

We thank Glenn Clifton for originally pointing out the uniqueness of the *Monardella* plants in the Black Mountains to one of the authors many years ago. We thank Susan Ashton for preparing the illustrations; Kirk Waln and James Holden for assistance determining locations and producing maps; Matt Ritter for his extraordinary efforts during the review and publication

process; Julie Vanderwier, Judy Hohman, and Margie Pelton Elvin for reviewing the manuscript prior to submission; and the curatorial staff of multiple herbaria who processed loans, imaged specimens, tracked down additional information on request, and provided assistance during visits: ARIZ, ASC, ASU, AZ, CAS, DES, DS, GH, GMDRC, JEPS, LA, MO, NDG, NY, POM, RM, RSA, SD, UC, UCR, UCSB, US, the herbarium at the Arizona Bureau of Land Management Phoenix District Office, and Glenn Clifton and his personal herbarium. We thank Jim Andre, Glenn Clifton, Bruce Baldwin, Thomas Daniel, and Barbara Ertter for discussions and ideas regarding the taxonomy of *Monardella*. We thank Linda Prince for discussions, preliminary genetic work, and cladistic and phylogenetic analyses in the genus. We thank Tim Thomas, Pam McKay, Glenn Clifton, Jim Andre, and Tasha La Doux for their kind assistance, support, and insights. We thank the International Plant Names Index, the Index to California Plant Names, the Southwest Environmental Information Network (SEINet), and the Consortium of California Herbaria (CCH).

Literature Cited

Abrams, L. R. 1912a. The *Monardella*s of southern California—I. Muhlenbergia 8:26–36.

———. 1912b. The *Monardella*s of southern California—II. Muhlenbergia 8:37–44.

———. 1951. Illustrated flora of the Pacific States, Vol. 3. Stanford University Press, Stanford, CA.

Baldwin, B. G., D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosatti, and D. H. Wilken (eds.). 2012. The Jepson manual: vascular plants of California, 2nd ed. University of California Press, Berkeley, CA.

Bentham, G. 1834. *Monardella*. Pp. 331–333 *in* Labiatarum genera et species. James Ridgway and Sons, London, U.K.

Elvin, M. A. and A. C. Sanders. 2003. A new species of *Monardella* (Lamiaceae) from Baja California, Mexico, and southern California, United States. Novon 13:425–432.

——— and ———. 2009. Nomenclatural changes for *Monardella* (Lamiaceae) in California. Novon 19:315–343.

Epling, C. C. 1925. Monograph of the genus *Monardella*. Annals of the Missouri Botanical Garden 12:1–106.

———. 1935. *Monardella robisonii*. Pp. 451–600 *in* P. A. Munz (ed.), A manual of southern California botany. Claremont College, Claremont, CA.

———. 1939. *Monardella arizonica*. Pp. 489–490 *in* T. H. Kearney and R. H. Peebles, (eds.), Arizona plants: new species, varieties, and combinations. Journal of the Washington Academy of Sciences. 29.

———. 1951. *Monardella*. Pp. 746–747, 1069 *in* T. H. Kearney and R. H. Peebles (eds.), 1964, Arizona Flora. University of California Press, Berkeley and Los Angeles, CA.

Gray, A. 1876. Miscellaneous botanical contributions. Proceedings of the American Academy of Arts 11:71–104.

———. 1886. *Monardella*. Pp. 459 *in* Synoptical flora of North America, ed. 2, Vol. 2, Pt. 1. Ivison, Blakeman, Taylor, and Co., New York, NY.

Hardham, C. B. 1966a. Three diploid species of the *Monardella villosa* complex. Leaflets of Western Botany 10:241.

———. 1966b. Two more diploid segregates of the *Monardella villosa* complex. Leaflets of Western Botany 10:320–326.

——— and J. A. Bartel. 1990. *Monardella stebbinsii* (Lamiaceae), a new serpentine endemic species from the northern Sierra Nevada, Plumas County, California. Aliso 12:693–699.

International Plant Names Index (IPNI). 2012. Website http://www.ipni.org [accessed 03 June 2012].

Jepson, W. L. 1925. A manual of the flowering plants of California. University of California Press, Berkeley, CA.

———. 1943. A flora of California, Vol. 3, Pt. 2. University of California Press, Berkeley, CA.

Jokerst, J. D. 1992. Nomenclatural changes in California *Monardella* (Lamiaceae). Phytologia 72:9–16.

———. 1993. *Monardella*. Pp. 718–727 *in* J. C. Hickman (ed.), The Jepson manual: higher plants of California. University of California Press, Berkeley, CA.

McDougall, W. B. 1973. Seed plants of Northern Arizona. The Museum of Northern Arizona, Flagstaff, AZ.

Munz, P. A. 1935. *Monardella*. Pp. 440–451, 600 *in* A manual of southern California botany. Claremont College, Claremont, CA.

———. 1959. A California flora. University of California Press, Berkeley, CA.

———. 1974. A flora of southern California. University of California Press, Berkeley, CA.

Richard, S. M., S. J. Reynolds, J. E. Spencer, and P. A. Pearthree. 2000. Geologic map of Arizona, Map 35. Arizona Geological Survey, Tucson, AZ.

Sanders, A. C., M. A. Elvin, and M. S. Brunell. 2012. *Monardella*. Pp. 842–850, 853 *in* B. G. Baldwin, D. H. Goldman, D. J. Keil, R. Patterson, T. J. Rosattiand, and D. H. Wilken (eds.), The Jepson manual: vascular plants of California, 2nd ed. University of California Press, Berkeley, CA.

Trauth-Nare, A. E. 2003. *Monardella*. 159, 168, *in* C. M. Christy with contributions by D. Z. Damrel, A. M. Henry, A. E. Trauth-Nare, R. Puente-Martinez, and G. M. Walters. Journal of the Arizona-Nevada Academy of Science 35:151–169.

U.S. Environmental Protection Agency. 2005. Omernik's level III ecoregions of the continental United States: national atlas of the United States, Reston, VA.

Van Devender, T. R., P. S. Martin, R. S. Thompson, K. L. Cole, A. J. T. Jull, A. Long, L. J. Toolin, and D. J. Donahue. 1985. Fossil packrat middens and the tandem accelerator mass spectrometer. Nature 317:610–613.